

WHAT IS CLAIMED IS:

1. A ferrous magnetic taggant system for monitoring a ratio of at least two components being combined in a mixture, comprising:

- 5       a first sensor for generating a first sense signal representing an amount of ferrous taggant particles per unit volume of a first component flowing adjacent said first sensor;
- a second sensor for generating a second sense signal representing an amount of ferrous taggant particles per unit volume of a mixture of the first component and a ferrous taggant particle free second component flowing adjacent said second sensor; and
- 10       a control means responsive to said first and second sense signals for calculating a ratio of the volumes of the first and second components in the mixture.

- 15       2. The system according to claim 1 wherein at least one of said first and second sensors has a generally tubular body with a central passage through which material flows, an inner sense coil extending about a circumference of said passage, a drive coil extending about a circumference of said inner sense coil, and an outer sense coil extending about a circumference of said drive coil.

- 20       3. The system according to claim 2 wherein said inner and outer sense coils each generate a coil signal in response to the presence of the ferrous taggant particles and including an instrumentation amplifier connected to said inner and outer sense coils for generating a sense signal representing a difference between said coil signals, said sense signal being one of said first and second sense signals.

4. The system according to claim 2 wherein said inner and outer sense coils are formed to generate mutually canceling coil signals when said passage is filled with air.

5. The system according to claim 1 wherein said control means compares a value of said first sense signal with a value of said second sense generated after a predetermined delay representing a time required for a portion of the first component to travel from said first sensor to said second sensor.

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6. The system according to claim 1 wherein said control means includes a constant current drive means generating current to a drive coil in at least one of said first and second sensors.

10 7. The system according to claim 1 wherein said control means is connected to an information processing device and generates an output signal representing the ratio of the volumes to said information processing device.

8. The system according to claim 1 wherein said control means includes an A/D  
15 converter for converting said first and second sense signals.

9. The system according to claim 1 wherein said control means includes a filter that generates a sine wave test signal with a frequency of "n" times a frequency of said first and second sense signals, said filter gathering four points ninety degrees apart for  
20 each of "n" cycles of the test signal, said filter subtracting a first one of the points from a third one of the points and subtracting a second one of the points from a fourth one of the points to obtain a pair of points for each of the cycles, and said filter averaging a first one of all of said pairs of points and averaging a second one of all of said pairs of points to obtain first and second averages respectively, said first and second averages representing  
25 an amplitude and phase of said first and second sense signals.

10. The system according to claim 1 including a master for calibrating said first and second sensors, said first and second sensors each having a passage through which material flows, said master having a body with a smaller diameter end sized to fit into  
30 said passages and a larger diameter end sized for use as a handle, said body further having a core formed from a filler material and a predetermined percentage of the ferrous taggant particles.

11. A method of monitoring a volume ratio of at least two components mixed together comprising the steps of:

- 5 a) providing a first sensor for generating a first sense signal representing an amount of ferrous taggant particles per unit volume of a first component flowing into a mixing device;
- b) providing a second sensor generating a second sense signal representing an amount of ferrous taggant particles per unit volume of a mixture of the first component and a ferrous taggant particle free second component flowing in the mixing device; and
- 10 c) providing control means for calculating a ratio of the volumes of the first and second components in the mixture.

12. The method of monitoring according to claim 11 including a step of operating said control means to compare a value of the first sense signal with a value of the second  
15 sense generated after a predetermined delay representing a time required for a portion of the first component to travel from the first sensor to the second sensor.

13. The method of monitoring according to claim 11 including a step of generating a sine wave test signal with a frequency of "n" times a frequency of the first  
20 and second sense signals, gathering four points ninety degrees apart for each of "n" cycles of the test signal, subtracting a first one of the points from a third one of the points and subtracting a second one of the points from a fourth one of the points to obtain a pair of points for each of the cycles, and averaging a first one of all of the pairs of points and averaging a second one of all of the pairs of points to obtain first and second averages  
25 respectively, the first and second averages representing an amplitude and phase of the first and second sense signals.

14. The method of monitoring according to claim 11 including a step of providing a master for calibrating the first and second sensors, the first and second sensors each having a passage through which material flows, the master having a body with a smaller diameter end sized to fit into the passages and a larger diameter end sized for use as a handle, the body further having a core formed from a filler material and a predetermined percentage of the ferrous taggant particles, and inserting the smaller diameter end into the passage of one of the first and second sensors.